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**The importance of
micro-data
for revealing income
motivated behaviour
among GPs**

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ABSTRACT

The objective of this paper is to demonstrate that micro data is fundamental for the study of income motivated behaviour among general practitioners (GPs).

We argue that a GP who experiences a shortage of patients in a mixed capitation and fee for service payment system, is likely to have a more service intensive practice style than his unconstrained colleagues. If he cannot have his optimal number of patients, a second best is to increase the number of services per patient if the income per time unit of providing services is greater than the marginal valuation of leisure. An empirical test requires micro data of GPs' rationing status. Data from the Norwegian capitation experiment provide us with this opportunity.

We find that the effect of patient shortage (strong rationing) on a GP's income from fees per patient is positive and statistically significant. Furthermore, we find that only the municipality with the lowest GP density has a negative and statistically significant effect. If only GP density data would have been available, we might erroneously have concluded that service provision among GPs is not income motivated. The reason is that aggregate data miss the within municipality variation in the actual number of patients relative to GPs' preferred numbers.

We conclude that macro data of GP density in an area are not likely to be useful in this context because the effect of better access is often not distinguishable from the effect of physician initiated services.

Introduction

The interpretation of a positive relation between the physician density in an area and the volume of medical care provision is a controversial issue. Some authors interpret the relation as a support of the hypothesis of supplier induced-demand, while others argue for the importance of patient initiated services as a result of better access. Many authors are critical as to whether empirical studies in fact have managed to distinguish effects of supplier-induced demand from effects of better access. Dranove and Wehner (1994) point out two factors that may cause the problem of identification: the first stage regression is not identified and border crossing of patients is not adequately addressed. The first factor stems from the fact that the number of physicians in an area may not be exogenous, but influenced by the volume of health services provided. Two stage least squares estimation is therefore required. The first stage identifies a physician supply equation, and ideally includes variables that are related to physician supply and unrelated to the demand for physician services. Dranove and Wehner (1994) question whether the variables used are able to identify the first stage regression.

In this paper we argue that micro-data describing whether a physician has obtained his optimal number of patients, are essential for the detection of income motivated behaviour among general practitioners. Our approach may be seen in relation to the literature review provided in Scott and Shiell (1997). They classify empirical studies of physicians' induced demand according to the kind of data that is employed. The first period of research, during the 1970s, is characterised by studies using aggregate utilisation data. In these studies the effect of demand creation is difficult to separate from the effect of better access. In the second period, the 1980s, studies often use service provision data at the individual physician level, mixed with aggregate area-level explanatory variables, such as physician density. These studies employ data with an hierarchical

structure without taking the possible correlation between error terms into account. Scott and Shiell (1997) improve the methods of earlier studies by taking account of the hierarchical structure of data. They find a relationship between physician density and the volume of service provision measured by the probability of a follow-up visit.

The objective of this paper is to take matters a step further, by arguing that micro-data that describe whether a physician has obtained his optimal number of patients, are required in the study of income motivated service provision in general practice. Macro data of general practitioner (GP) density in an area (in the Norwegian context the municipality) are not likely to be useful because the effect of better access is often not distinguishable from physician initiated services. In our approach the crucial distinction is between those GPs who provide care to their optimal number of patients and those who experience a shortage of patients. The second group is denoted as rationed GPs. If GPs with a smaller number of patients than their optimal number provide a number of services to their patients that differ from their unconstrained colleagues, we conclude that their intensity of service provision deviates from their unconstrained optimal volume.

Our argument is illustrated by a study that employs data from the Norwegian capitation experiment initiated by the central government in the early 1990s. The idea behind this experiment was that a contractual relationship between a person and his or her GP would encourage a stable relationship adapted to individual needs¹. Due to the experiment, the payment system for GPs was also changed. In the previous system most GPs were self-employed contract physicians while the rest were municipal employees on a fixed salary. In the new remuneration system a GP's income consists of a per capita component per listed person and a fee-per-item

¹ The system with capitation in general practice has long since been established in countries like Denmark, the Netherlands and the UK.

component. Compared with the remuneration system of the contract physician, the municipal grant and some fees were replaced by the capitation component. The capitation fee is adjusted for a listed person's age and adjusted for whether the physician is a specialist in general practice. The fee-per-item component from the National Insurance Scheme and from patient charges is paid according to a fixed fee schedule². The fees depend, for instance, on the duration of a consultation and on whether certain types of examinations and laboratory tests are initiated during the consultation³.

All GPs in four municipalities participated in the experiment, and all inhabitants in these municipalities were listed by a GP. The list system then implies that both the number of patients and the distribution of patients according to age and gender at the individual practice level are public information. Previously, it was not known whether a “number of consultations” during a certain period were provided to a large or a small number of persons, making it difficult to compare GPs' practice styles. We also have ex ante information about the number of persons that each GP would like to have on his list at the start of the experiment. A GP's preferred list size reveals information about a physician's preferred practice style and his preferred workload. By comparing preferred list size ex ante and actual list size during the experimental period we can distinguish empirically between those GPs who experience a shortage of patients (rationing) and those who do not.

In section 2 we shall argue that a GP who experiences a shortage of patients in a mixed capitation and fee for service payment system, is likely to have a more service intensive practice style than his unconstrained colleagues. If he cannot have his optimal number of patients, a

² The sizes of the different fees are decided in centralised negotiations between the Norwegian Medical Association and the state.

³ About 50 per cent of the income of an average practice are expected to come from the capitation component, and about 50 per cent from the fee-per-item part.

second best is to increase the number of services per patient if the income per time unit of providing services is greater than the marginal valuation of leisure.

The data are described in section 3, and the results from our empirical study are presented in section 4. We find that the effect of patient shortage (strong rationing) on a GP's income from fees per patient is positive and statistically significant. Furthermore, we find that only the municipality with the lowest GP density has a negative and statistically significant effect on service provision. If only GP density data would have been available, we might erroneously have concluded that service provision among GPs is not income motivated. The reason is that aggregate data miss the within municipality variation in the actual number of patients relative to GPs' preferred number. We conclude that macro data of GP density in an area are not likely to be useful in this context because the effect of better access is often not distinguishable from the effect of physician initiated services.

1 Patient shortage and the intensity of service provision

In related work (Iversen and Lurås, 1998) we have shown that a shortage of patients is likely to imply a more service intensive practice style among general practitioners. Our point of departure is the observed variation in medical practice and its implication for the variation in the provision of health services. For instance, views among physicians may differ with respect to how often a patient with diabetes or a patient with hypertension should be called for check-ups. Views may also differ on whether a GP who prescribes antibiotics to a patient should call in the patient for a follow-up consultation next week, or ask the patient to contact him if he feels worse. The intensity of service provision will on average be higher in the first case than in the second.

We argue that for many treatment choices there is an interval of health service provision where the marginal effect on health is not documented to be different from zero⁴. For our purpose, an interesting consequence of the lack of medical standards is that several practice profiles are all regarded as equally satisfactory from a professional point of view. We assume that among these practice styles a physician chooses the one that maximises his objective function with consumption and leisure as arguments. A physician's practice style is simply defined as the optimal value of his decision variables; the number of patients and the number of services provided to each patient. Hence, his personal interests influence the style of medicine he believes in. But since all feasible practice styles are assumed to have a marginal effect of health services on health equal to zero, our approach implies that a patient's health is never balanced against the GP's income or leisure. This assumption simplifies the formal reasoning considerably, but is not critical for the argument. A relaxation of the assumption would imply that the effect of economic incentives is strengthened.

The maximisation problem is analysed by means of concave programming. Since our data are from a mixed capitation and fee for service system, we concentrate on the predictions under this payment system⁵. Assuming one type of health services we have⁶:

⁴ In the health economics literature this interval is often referred to as "flat of the curve medicine", see for instance Enthoven (1980).

⁵ We skip the formal argument in this paper, and refer interested readers to Iversen and Lurås (1998a).

⁶ In Iversen and Lurås (1998a) we have two types of health services and hence, an additional effect of the relative fees. Since the focus of the present paper is different, we simplify without loss of important points.

*Result:**In a combined capitation and fee-per-item system:*

- *The minimum volume of health services per patient is provided when patients are abundant*
- *When a shortage of patients occurs, the volume of service provision per patient may exceed the minimum volume.*

The intuition behind this result is straight forward: In a combined capitation and fee for service system an increase in the level of service provision to existing patients has an opportunity cost, since the time could have been used to providing services to additional patients. Since providing services to additional patients would also result in a capitation fee, providing services to additional patients is always more rewarding than increasing the service provision to patients already listed. When a shortage of patients occurs, increasing the list of patients is not longer an option. The amount of service provision per patient will then exceed the minimum if the marginal income of service provision per unit of time exceeds the marginal valuation of leisure. The more the rationing hurts (measured by the magnitude of the Lagrange-parameter), the more service intensive is the practice style likely to be.

Our model predicts that a GP experiencing patient shortage has economic motives for a service intensive practice style. An empirical test requires micro data of whether a GP in fact experiences patient shortage. Macro data of GP density in an area (in the Norwegian context the municipality) are not likely to be useful for this purpose for several reasons:

- The population in municipalities with a high GP density may experience better access and hence, a lower threshold for patient initiated contacts
- GPs in high-density municipalities may over time develop a culture of service intensive practice style not because of economic motives but because they think patients are served better.

- Average GP density does not take account of variation within a municipality. Even in municipalities with a high GP density, individual GPs may experience a shortage of patients.

Hence, it is useful to distinguish between:

- variation in GP density between municipalities and
- variation within a municipality, measured by micro data on individual GPs' experiences of patient shortage.

We suggest that the first type of variation, the between municipality variation, is useful for studying the effect of access on service provision. The second type of variation, the within municipality variation, is however essential for the study of whether service provision is motivated by the income it generates. The data we possess are capable of distinguishing between these two types of variation.

2 Description of the data

Data from the Norwegian capitation trial are applied. Annual data for each physician's practice income were collected in 1994 and 1995. The total fee-for-service component consists of the payment from the National Insurance Scheme and from patient charges. This aggregate is used as an indicator of the total volume of services provided in a GP's practice during one year (INPERCAP). Data describing the composition of the fee-for-service component were collected in two representative periods of 14 days - one in March 1994 and one in March 1995.

Only physicians with more than 500 persons on the list and income data of sufficient quality were included. Four physicians were excluded from the data set because they were outliers⁷. Our income data then consist of 218 observations, while the service provision data include 183 observations.

One important conclusion from our theoretical model is that physicians who experience a shortage of patients have a more service intensive practice style than their unconstrained colleagues. To account for differences in practice style between various groups of physicians, we included dummy variables in the analysis. Two dummy variables indicate whether GPs are rationed. Before the experiment started, all the participating GPs were asked to specify the number of persons they would like to have on their individual lists (PRELISTSIZE). It is important to note that a GP both takes account of his own characteristics, such as family situation and medical experiences, and his own practice style when he expresses his preferred list size. For instance, one GP may wish to work ten hours each day, another prefers a part-time job, one prefers short consultations and yet another prefers to use considerable time on a patient during the consultation. It follows that the preferred number of persons on the list is likely to vary substantially between GPs. For each GP we compare preferred list size and actual list size and obtain an indicator of individual patient constraints. Hence, the absolute size of the lists and the reason why the size varies between GPs is not an issue in this study.

The dummy variable RATION_A is equal to one for those physicians who had a smaller list than they wanted in period one and experienced a net increase in the number of patients from period one to period two. The second dummy variable, RATION_B, is equal to one for those physicians who had a smaller list than they wanted in period one and experienced a constant or a declining number of patients from period one to period two. Our data then consist of three groups of GPs according

⁷ Their registered income per listed patient differed substantially between 1994 and 1995. We therefore suspect that an extraordinary time lag between service provision and income registration occurred in one of the years.

to rationing status: unrationed, lightly rationed (RATION_A) and strongly rationed (RATION_B) GPs. We predict that constrained GPs consider an increased number of patients in period two as a signal of a less severe constraint. Accordingly, it is optimal for them to have a less service intensive practice style than their colleagues experiencing a shortage of patients in the first period and a constant or a declining list of patients in the second period. Hence, the effect of both light and strong rationing on service provision is expected to be positive, and the effect of the former is expected to be weaker than the effect of the latter.

The distribution of patients according to age and gender is expected to influence the volume of services provided. It is well known from various studies that females have more frequent consultations than men and that the elderly have more frequent consultations than younger (disregarding the infant age) people (Elstad 1991). As an indicator of the patient load we used the female proportion of patients (PROPFEM) and the proportion of patients aged seventy and older (PROPOLD). These data were collected annually. Female physicians seem to have a practise style that differs from their male colleagues (Langwell 1982). Kristiansen and Mooney (1993) found that on average female GPs had longer consultations than male GPs. In the analysis we take account of the physician's gender (FEMALE). All the GPs in our set of data are self-employed. Prior to the capitation experiment, however, some of the physicians were employed by the municipality on a fixed wage contract. It follows that they were unfamiliar with the fee schedule compared with their privately practising colleagues. In the transition period the income from fees may therefore underestimate their volume of service provision.

We therefore introduced a dummy variable to account for the physician's employment status before the experiment (SALARIED).

TABLE 1

From table 1 we see that the mean annual income from fees and patient charges per person listed for the whole sample of GPs was NOK 237. On average, 51 per cent of the persons on the individual lists were women and nearly 10 per cent were aged 70 and older. 37 per cent of the physicians included were salaried community physicians prior to the experiment and 26 per cent of the physicians were female. During the 14 days of registration the GPs on average provided 0.07 consultations, 0.07 laboratory tests and used the duration-dependent fee 0.02 times per listed person. Calculated on an annual basis (multiplied by 26), our figures correspond to 1.9 consultations per person per year.

Almost 40 per cent of the GPs were lightly rationed and 26 per cent experienced strong rationing. Hence, almost 66 per cent of the physicians experienced a smaller list in period 1 than they preferred when the experiment was initiated. As seen from table 1, the strongly rationed group annually earns NOK 50 more per listed person from the fee-for-service component than their unrationed colleagues. On average, both categories of rationed GPs provide more consultations, use the duration-dependent fee to a greater extent and provide more laboratory tests per listed person than their unconstrained colleagues.

To account for the between municipalities differences in practice style between GPs we included three dummy variables; MUNIC2, MUNIC3 and MUNIC4. The number of inhabitants per GP is increasing in the denomination of municipalities, i.e. the GP density is highest in MUNIC1 and lowest in MUNIC4.

TABLE 2

Table 2 shows differences between the four municipalities according to the preferred number of patients (PRELISTSIZE) and the actual number of patients (LISTSIZE). We notice the huge

difference between municipalities regarding the number of patients GPs would like to have on their list. A likely explanation is the variation in GP density among the municipalities. For instance, in municipalities 3 and 4 the GP density was quite low before the experiment started. Hence, each GP had to take care of a large number of patients. Their statements on preferred list size seem to correspond to what they were used to. We also note that in municipalities 2 and 3 there are huge positive differences between the preferred and the actual list size, while in municipality 4 the actual list size is larger than the preferred list size. This difference is also reflected in the average values of the rationing variables; nearly 80 per cent of the GPs in municipality 3, and only 40 per cent of the GPs in municipality 4 did not achieve their preferred number of patients.

3 Estimation and results

Because there are two periods of observations of GPs, and each GP belongs to a specific municipality⁸, our data have a hierarchical structure. Since the municipality effects are of special interest and we only have four municipalities, we choose to include the municipalities as fixed effects. Each GP has a certain practice style related to his personality, his experience, the organisation of the practice, etc. It is then reasonable to assume dependence between the observations in period one and period two for each GP. Hence, our data set has a panel data structure.

We assume a random effects model:

⁸ In the annual income data there are 218 observations (level 1) of 109 different GPs (level 2) from 4 municipalities (level 3).

$$y_{it} = a_i + bx_{it} + v_{it} \quad \text{where } a_i = a + u_i \quad (1)$$

Equation (1) is a regression model with a random intercept, with all other coefficients being fixed. y_{it} is the dependent variable with a subscript indicating observation no. t ($t = 1, 2$) of GP number i ($i = 1, 2, \dots, 109$) and x_{it} is a vector of independent variables with a similar subscript. u_i is the random individual effect and v_{it} is the remainder. The two components are assumed to be independent of each other, each one being i.i.d. with zero mean and with variance respectively σ_u^2 and σ_v^2 . We used the statistical software TSP 4.4.

TABLE 3

Table 3 shows the results from the estimation of two models: Model A includes municipality dummies only, while model B includes rationing dummies as well as municipality dummies. From the coefficients of model A we see the effects of all municipality dummies are negative and the absolute value of the effect increases with the number of inhabitants per GP. Only the effect of the municipality with the highest number of inhabitants per GP is statistically significant. A GP in MUNIC4 is expected to have about NOK 79 lower income from fees per person listed than a GP in MUNIC1. The municipality dummies of model B is of about the same magnitude as of model A. Also in model B only the effect of MUNIC4 is statistically significant. From the coefficients of RATION_A and RATION_B we see that patient shortage is expected to increase the income from fees per listed person. Only the effect of RATION_B is statistically significant. GPs experiencing strong rationing are expected to generate NOK 38 more from fees per listed patient than their unrationed colleagues.

4 Concluding remarks

The objective of this paper is to argue that micro data is fundamental for the study of income motivated behaviour among general practitioners. In section 2 we argued that a GP who experiences a shortage of patients in a mixed capitation and fee for service payment system, is likely to have a more service intensive practice style than his unconstrained colleagues. If he cannot have his optimal number of patients, a second best is to increase the number of services per patient if the income per time unit of providing services is greater than the marginal valuation of leisure.

An empirical test of this income-generating hypothesis requires micro data of whether a GP in fact experiences patient shortage. Macro data of GP density in an area (in the Norwegian context the municipality) are not likely to be useful because the effect of better access is often not distinguishable from the effect of physician initiated services.

For the purpose of empirical studies, a capitation system is attractive since each GP's number of patients is known from administrative data. Since we also have access to individual GPs' statements of their preferred number of patients, we are able to distinguish between the GPs who experience a shortage of patients and the GPs who have achieved their optimal number of patients. To account for the differences in GP density and other area specific characteristics we introduce municipality variables as fixed effects.

The results of our empirical analysis show that the effect of patient shortage (strong rationing) on a GP's income from fees per patient is positive and statistically significant. Furthermore, we find that only the municipality with the lowest GP density has a negative and statistically significant effect. If only GP density data would have been available, we might erroneously have concluded that income motivated behaviour among GPs is not detected. The reason is that with aggregate

data we miss the within municipality variation in the actual number of patients relative to the preferred number.

This point is further illustrated in table 4. Table 4 displays a quantitative picture of the municipality effect and the patient shortage effect calculated by means of the estimated coefficients of Model B and the mean composition of patients with regard to age and gender. Also, non-significant effects are included.

TABLE 4

We see from table 4 that the municipality effect reduces the income from fees per listed person as the GP density is reduced. We also see that the income per listed person increases, as rationing becomes more severe. But even if he is strongly rationed, a GP in municipality 3 or municipality 4 is expected to have a lower income per listed person than an unrationed GP in municipality 1. Still he has a higher income per patient than the unrationed colleagues in his own municipality. This variation is not accounted for when aggregate data are employed.

Several critical points could be raised against our approach and the data we employ. For instance, one could claim that the effect we find of patient shortage stems from the fact that we do not distinguish between those GPs who have got their preferred number of patients and those who have got more than their preferred number. From table 1 we see that among the unrationed the average list size is greater than the average preferred number. We therefore split the unrationed group into two parts and introduced a dummy variable equal to one for those GPs who had more than 100 patients in excess of the preferred number. True enough, the effect of this variable has a negative sign, but the effect is far from being statistically significant⁹.

One could also question the validity of the variable describing a GP's preferred number of patients, since the value of this variable is self reported by the GP. However, we cannot see there is an incentive for a systematic bias. By overstating the true number a GP runs the risk of a less

⁹ The magnitude of the effect of strong rationing is slightly smaller than in our original analysis, but statistically

than optimal amount of leisure, while underreporting the true number may result in a smaller than optimal income.

A GP may have certain possibilities of regulating his own workload by referring patients to treatment by a specialist. Referrals are not included in this paper. In a related paper (Iversen and Lurås, 1998b) we found an increase in the referral rate in one of the municipalities after the capitation system was introduced. We found however no statistically significant effect of whether a GP is rationed or not

Finally, our concepts of weak and strong rationing are essentially dynamic concepts requiring dynamic modelling. Rationed GPs may have different strategies for increasing the size of the list relative to increasing the intensity of treatment, depending on the cost compared to the benefit of alternative strategies. These dynamic aspects will be addressed in our future research.

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Table 1: Descriptive statistics - mean (standard deviation) of the variables

Variable	Definition	Unrationed (sufficient patients) (76 GPs)	Ration_A (desired< actual, and increasing) (86 GPs)	Ration_B (desired< actual, and constant or declining) (56 GPs)	All GPs (218 GPs)
Inpercap	Annual income from fees and patient charges per listed person in NOK	NOK 211 (NOK 63)	NOK 245 (NOK 69)	NOK 262 (NOK 83)	NOK 237 (NOK 73)
Duration*	The number of consultations per listed person where a GP uses the duration dependent fee	0.016 (0.015)	0.027 (0.021)	0.029 (0.023)	0.024 (0.02)
# Labs*	The number of laboratory tests per listed person	0.06 (0.04)	0.062 (0.051)	0.09 (0.063)	0.069 (0.053)
Consults*	The number of consultations per enlisted person	0.062 (0.033)	0.07 (0.041)	0.08 (0.041)	0.07 (0.039)
Prelistsize	A GP's statement of preferred list size before the capitation experiment started	1698 (461)	1931 (409)	1961 (400)	1858 (440)
List size	The actual number of persons on a GP's individual list	1869 (427)	1546 (365)	1757 (435)	1713 (428)
Propold	The proportion of persons aged 70 and older on the list	0.082 (0.059)	0.094 (0.045)	0.119 (0.071)	0.096 (0.059)
Propfem	The proportion of females on the list	0.535 (0.109)	0.471 (0.11)	0.52 (0.091)	0.506 (0.108)
Female	A dummy variable equal to one if the physician is a female	0.368	0.14	0.286	0.257
Salaried	A dummy variable equal to one if the physician was a salaried community physician prior to the experiment	0.395	0.279	0.464	0.367

* : For these variables we have observations of 183 GPs during two periods of 14 days

Table 2: Descriptive statistics - mean and standard deviation (in parenthesis) – according to municipalities

	Municipality 1	Municipality 2	Municipality 3	Municipality 4
PRELISTSIZE	1.383 (450)	1.610 (412)	1.944 (404)	1.820 (455)
LISTSIZE	1.353 (460)	1.475 (697)	1.717 (308)	1.840 (469)
RATION_A	33 % (50%)	57 % (50%)	49 % (45%)	16 % (37%)
RATION_B	33 % (50%)	1 % (26%)	28 % (45%)	24 % (43%)

Table 3: The estimated effect of a shortage of patients on income per person listed (INPERCAP) (standard deviations in parenthesis)¹⁰

	Model A	Model B
CONSTANT	225.0* (48.1)	210.1* (51.1)
PROPOLD	286.6* (123.5)	211.0 (128.5)
PROPFEM	65.2 (82.0)	82.7 (83.1)
GENDER	-17.4 (22.9)	-20.1 (22.3)
SALARIED	6.7 (14.3)	1.3 (14.6)
RATION_A		23.3 (14.5)
RATION_B		38.4* (15.8)
MUNICIPALITY 2	-29.7 (31.8)	-27.0 (31.1)
MUNICIPALITY 3	-41.1 (27.8)	-47.4 (27.2)
MUNICIPALITY 4	-78.7* (29.5)	-76.2* (29.1)
Number of observations	218	218
Adjusted R ²	0.16	0.19
Hausman	CHISQ(2) = 1.9723	CHISQ(2) = 2.2041
test	p-value = 0.3730	p-value = 0.3322

¹⁰ '*' indicates that the estimated parameter is significantly different from zero at the five per cent level with a two tailed test.

Table 4: Expected income from fee for service per listed person according to rationing-status and municipality, parameters from table 3, model B.

	UNRATIONED	RATION_A	RATION_B
MUNICIPALITY 1	272 NOK	296 NOK	311NOK
MUNICIPALITY 2	245 NOK	269 NOK	284 NOK
MUNICIPALITY 3	225 NOK	248 NOK	263 NOK
MUNICIPALITY 4	196 NOK	219 NOK	234 NOK